Guidelines for Calculating Emissions from Dairy and Poultry Operations

December 2016

The dairy and poultry farms are required to report to the SCAQMD their emissions of Volatile Organic Compounds (VOC), Particulate Matter (PM) and Ammonia (NH_3) that result from the handling of livestock waste. For poultry operations, there are additional PM emissions from bird feed.

1. PROCEDURES

Facilities can estimate their VOC, PM, and NH_3 emissions using the equation:

$$E = Q * EF * (1 – CE)$$

Where,

E = VOC, PM or NH_3 emissions, expressed in pounds per year (lbs/yr)

Q = Throughput is the number of animals per reporting year by animal category. For poultry farms, the throughput is also expressed in tons of bird feed when estimating PM emissions from bird feed.

EF = Uncontrolled emission factors from Table 1 based on the animal categories and materials.

CE = Control effectiveness listed in Table 2 based on the types of manure disposal practices.

Table 1: Uncontrolled Emission Factors

Animals/Operations	VOC lbs/head	PM		NH_3 lbs/head
		lbs/head	lbs/ton	
Dairy Farms:				
Milking Cows	12.8	3.56	---	74.0
Dry Cows	8.7	3.56	---	45.4
Heifers (4-24 months)	6.1	3.56	---	27.8
Heifers (4-24 months)*	4.4	3.56	---	27.8
Calf (under 3 months)	4.5	3.56	---	23.6
Mature Cows*	6.3	3.56	---	74.0
Poultry Farms:				
Manure	0.02565	0.0616	---	0.096
Feed	---	---	0.108	---

*Emission factors for dairy operations with flush lanes that are flushed with water to a holding pond.

- *Milking cow is a cow raised to produce milk*
- *Dry cow is a cow of approximately 2 weeks from calving and in between lactation, hence, is not giving milk and is usually kept separately for different feeding*
- *Heifer is a young female calf under 3 years old and has not borne a calf*
- *Calf is a young cow or bull in its first year*
- *Mature cow is a cow that has had one or two calves and which may be more than 3 years old*

Table 2- Control Effectiveness

Type of Disposal	(VOC & NH_3) Control Effectiveness	(PM) Control Effectiveness
No Disposal	---	---
Best Management Practices	---	0.20
Manure Sent out of Basin	0.50	---
Composting (open window)	0.385	---
Composting (enclosed)	0.475	---
Digester (plug & complete mix)	1.0	---
Land Application	0.115	---

- *Best Management Practices are Class One Mitigation Measures defined in Rule 223, Appendix A, Table 1, subsections E & F, and Table 2, subsections C & D.*
- *Land Application is the use of methods such as tilling, injecting, or plowing that covers animal waste in accordance with NRCS Agricultural Waste Management Field Handbook Chapter 10, Section 651.1102.*

2. HOW TO REPORT

VOC, PM, NH_3 emissions must be reported separately for each animal category (i.e., milking cows, dry cows, heifers, birds, etc.). This can be done through the following steps:

1. Determine the annual average number of animals, (Throughput, Q):
    - For a dairy farm, take the annual average number of animals for each annual category from the annual report submitted to the Santa Ana Regional Water Quality Control Board (SARWQCB).

- For a poultry farm, take the annual average number of birds using your annual recordkeeping report. In addition, the total amount of bird feed used for the same time period is also needed.

2. Select proper emission factors listed in Table 1, (EF):
   - Note that the VOC emission factors are different based on the animal category (e.g., milking cows versus dry cows) and whether the dairy farm has lanes that are flushed with water to a holding pond.
   - Note that the PM emission factors are different based on the source of emissions (bird's manure or feed). There are no VOC or NH_3 emissions associated with bird feed.
3. Select appropriate control effectiveness (CE) from Table 2 based on the type of emissions (i.e., VOC, PM, or NH_3) and manure handling method.
4. Enter the information into the AER Reporting Tool.

EXAMPLE 1:

Last year, a dairy farm facility has reported to the Santa Ana Regional Water Quality Control Board 900 milking cows, 300 heifers (17-14 months) and no calves. The manure is sent out of the basin. This dairy does not have any lanes that are flushed with water to a pond.

STEPS TO REPORT THE EMISSIONS

Image 1: Click **Emission Sources (ES)**. The reporting tool displays existing permitted units (emission sources) as shown at bottom of the image below. If livestock waste handling is not listed, it must be added to the list by clicking Add New Emission Source. In this example, this farm is operated with a permit. Click on the hyperlink Open for ES#1 which will take user to image 2 below.

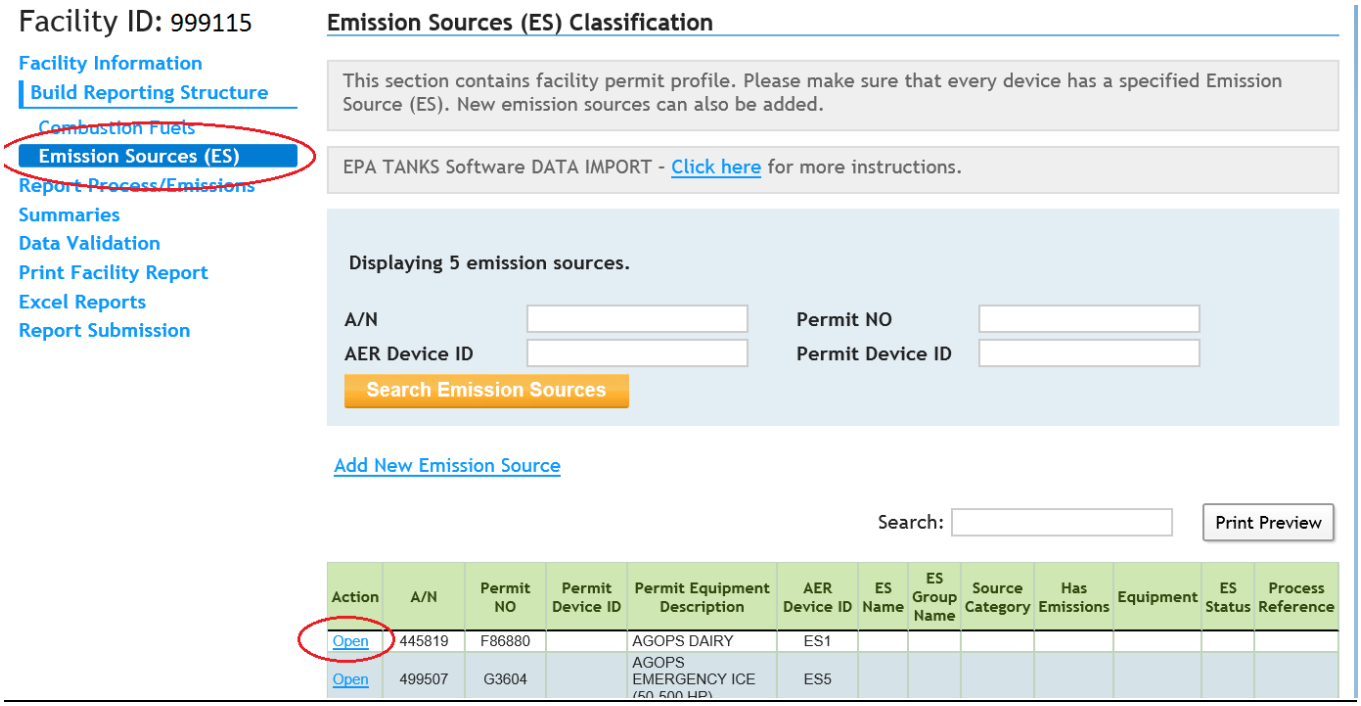


Image 2: Fill out relevant information to the Emission Source by identifying ES Name (example, Animal Waste Handling) and selecting the Operating ES Status (i.e., Normal Operation) from the drop-down menu. After selecting the appropriate Operating ES Status, the **Categorize Emission Source** button will appear. By clicking this button, the tool will take the user to the next screen (image 3 below) for categorizing this emission source.

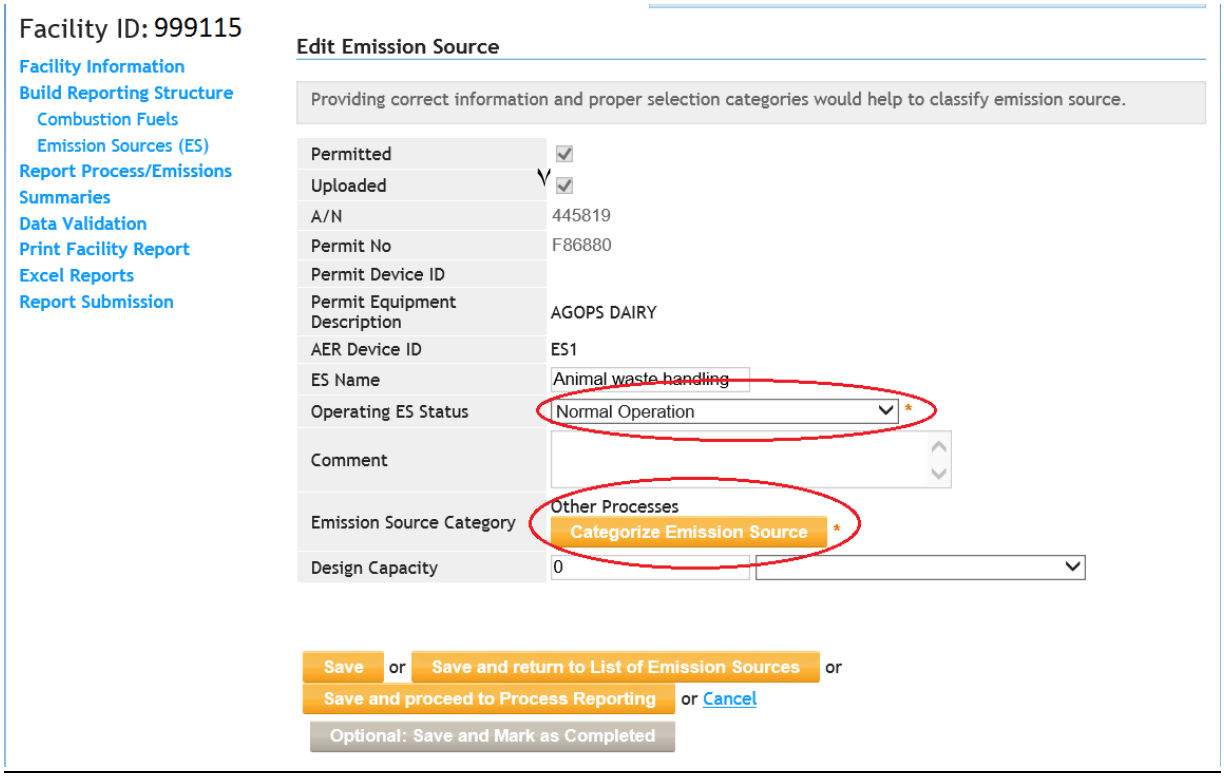
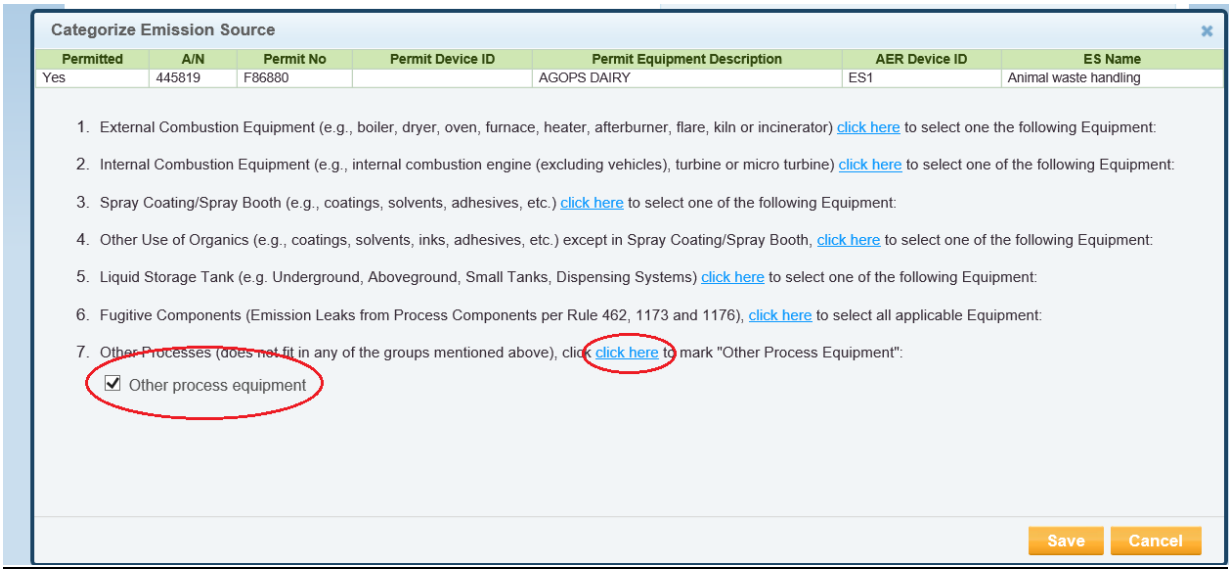


Image 3: In this example, user selects No. 7 by clicking on any part of the selection. Click the box designated as "Other process equipment", and click **Save** button.



After saving, the program return user to Image 2. Click "**Save and proceed to Process Reporting**" which will take the user to the screen shown in Image 4 for reporting emissions for this emission source.

Image 4: The reporting tool adds a new Process (P1). Click the hyperlink "Open" for entering process information such as throughputs, emissions, emission factors, and TACs as shown in Image 5.

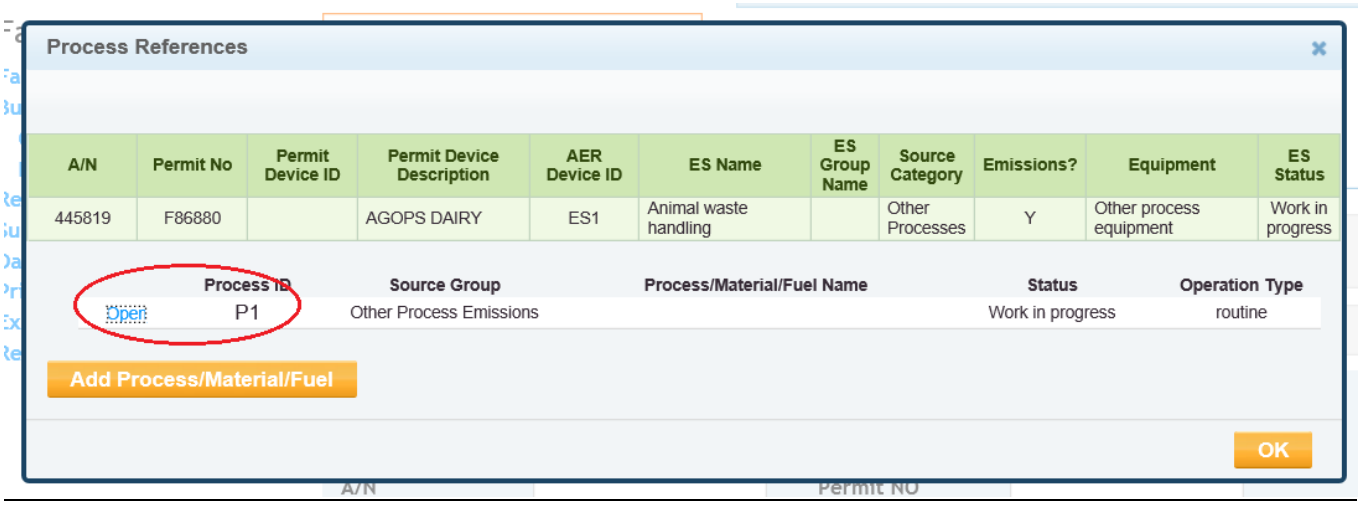


Image 5: The hyperlinks "Open" are designated for data entry to each section. The first one is for process information as shown in Image 6 below.

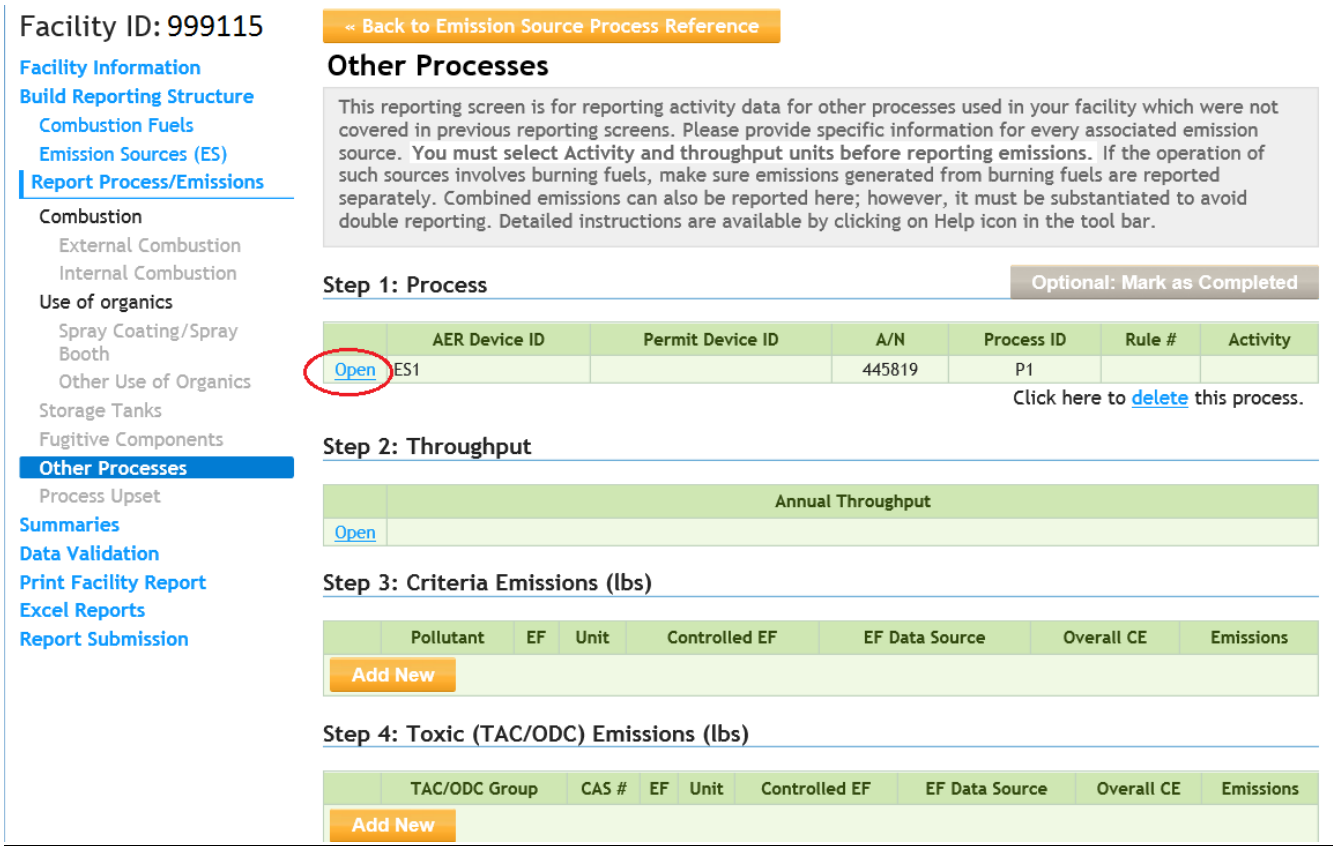


Image 6: After clicking Open, this image will pop-out. Identify the Process Name for the first process P1 and fill out the Activity Code by selecting the appropriate information from the drop-down menu from each box. Example shows correct sector, industry, operation, process, and rule for the milking cows. Click **Save** button.

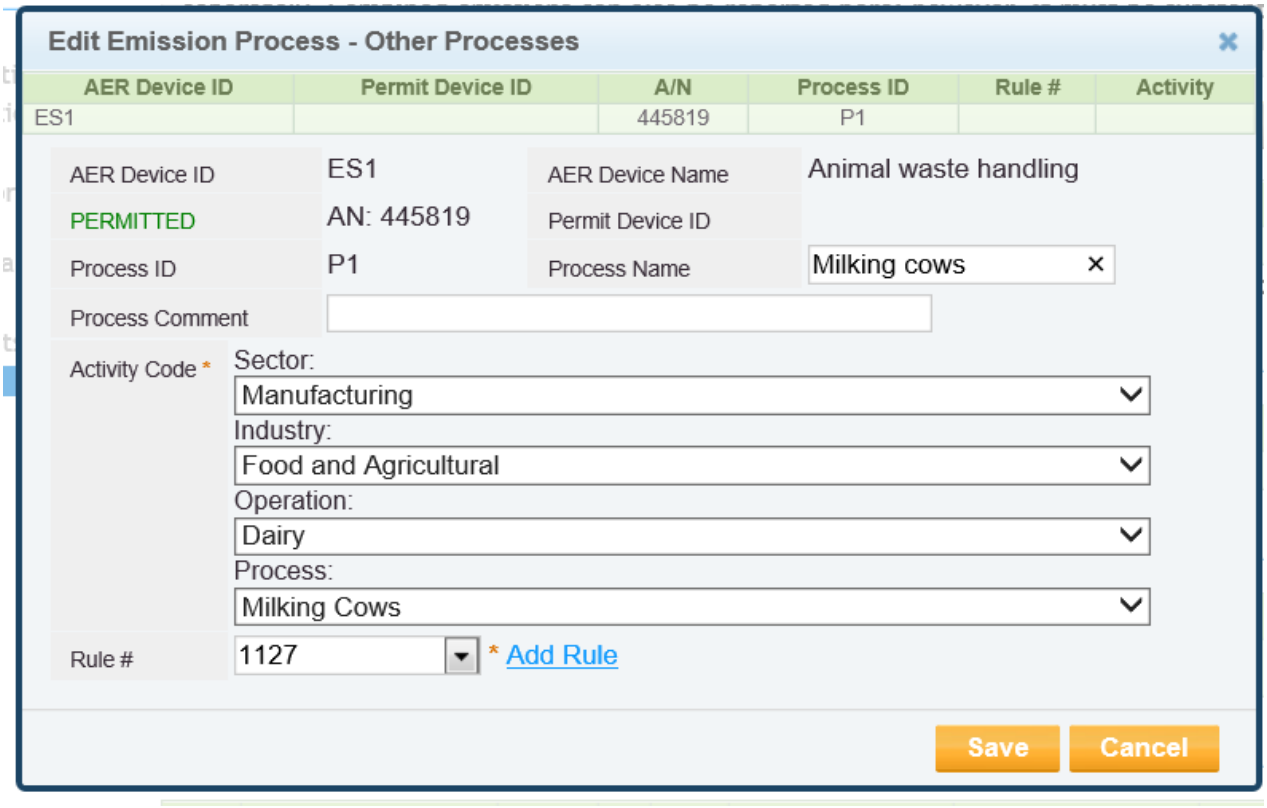


Image 7: After saving, the program returns to Image 5. This time, open the **Throughput** section (see Image 5) to enter the Annual Throughput, Type and Comment for the Process, as shown below. Click the **Save** button.

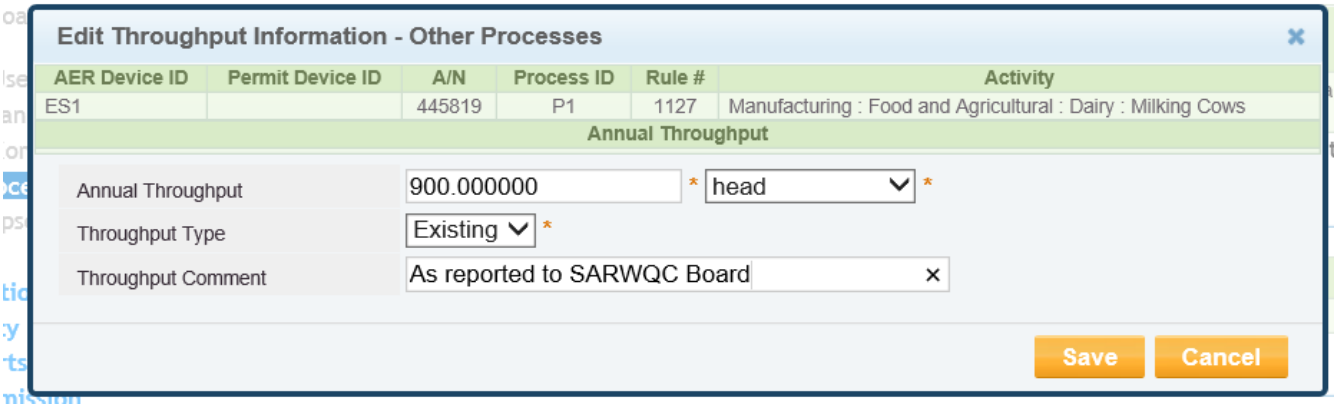


Image 8: After saving, the program returns to Image 5. Add the Criteria Emissions generated by the Process by clicking "**Add New"** (yellow button)" under **Criteria Emissions** section.

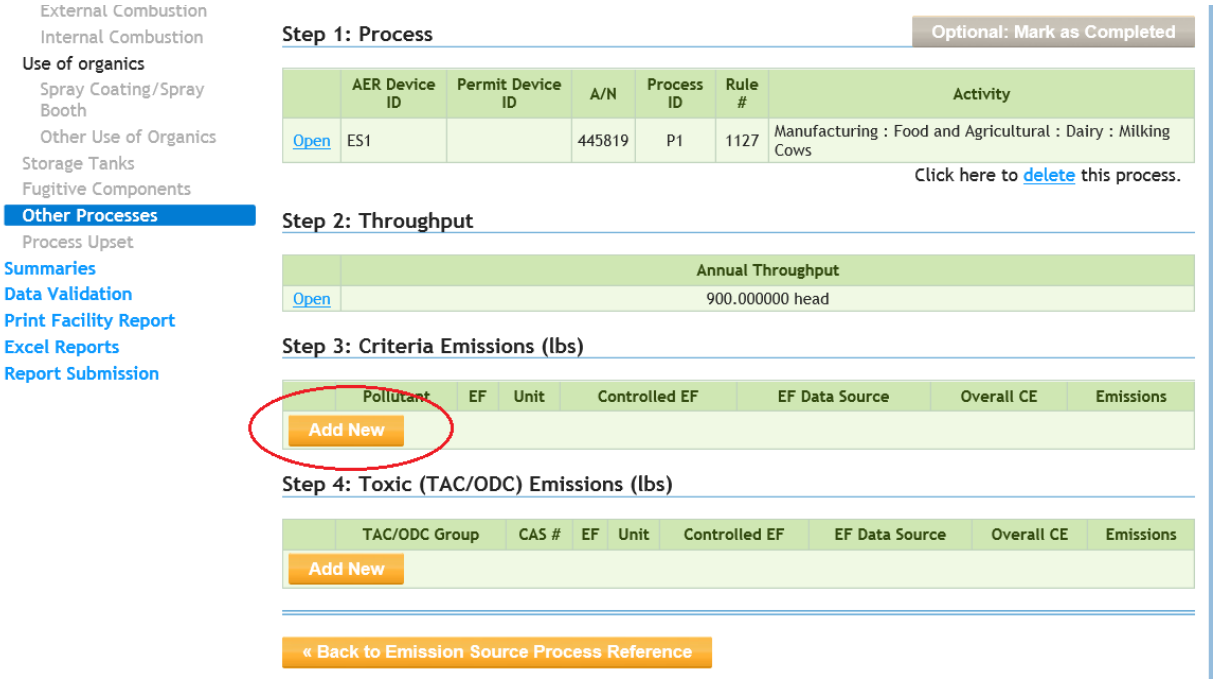


Image 9: Select the type of pollutant, (i.e., VOC, etc.) from drop-down menu, enter the applicable emission factor (from Table 1), control efficiency (from Table 2), emission factor comment and the emission factor data source for the Process. Click **Save** button.

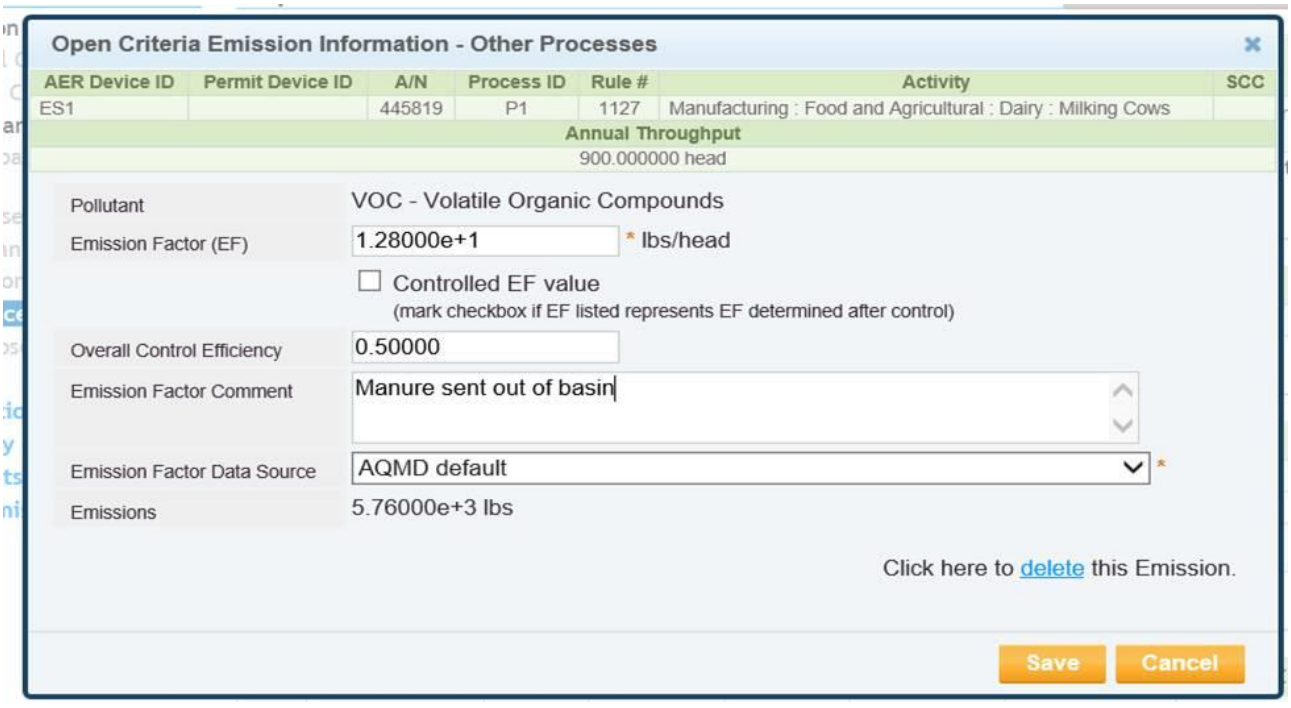
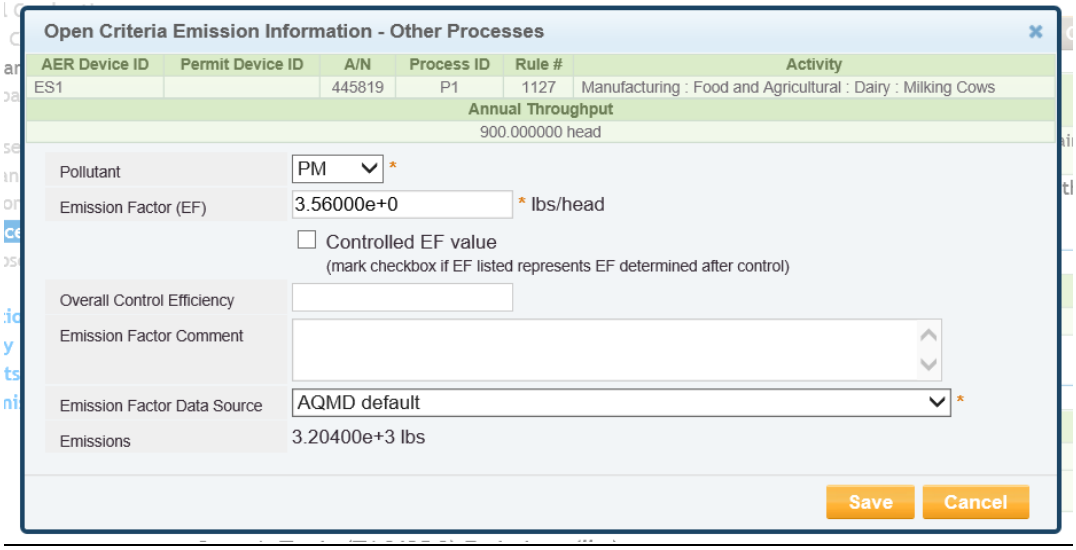
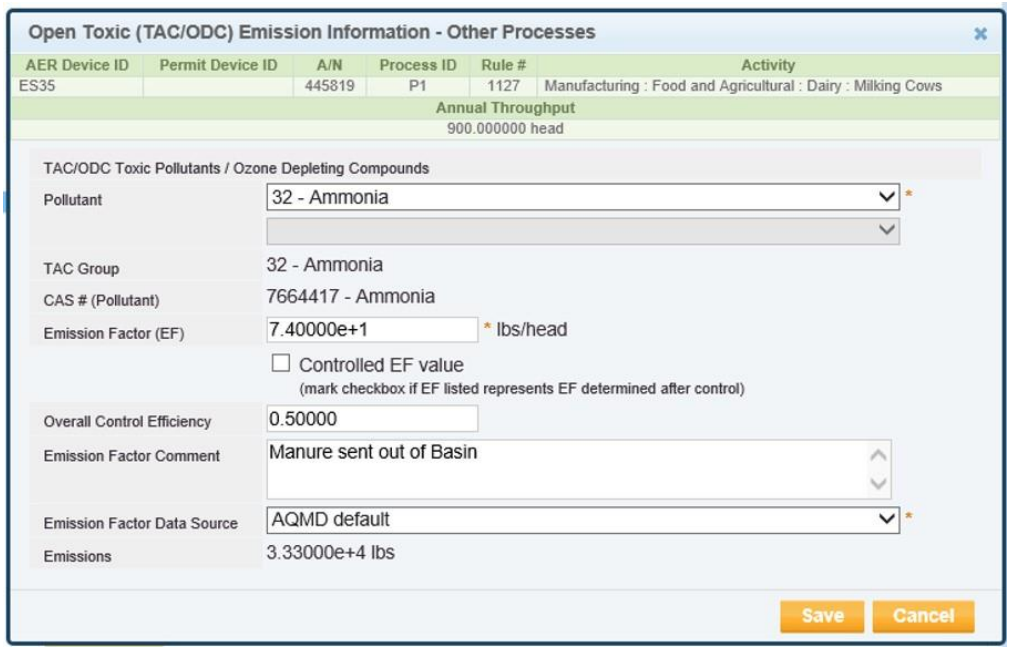


Image 10: After saving, the program returns to Image 5. To add the next pollutant type (PM) for the same Process P1, click the **Add New** button under **Criteria Emissions** section, Select PM from the drop-down menu, enter the applicable emission factor (from Table 1), control efficiency (from Table 2), emission factor comment and emission factor data source and enter them in the appropriate boxes. Click the **Save** button.

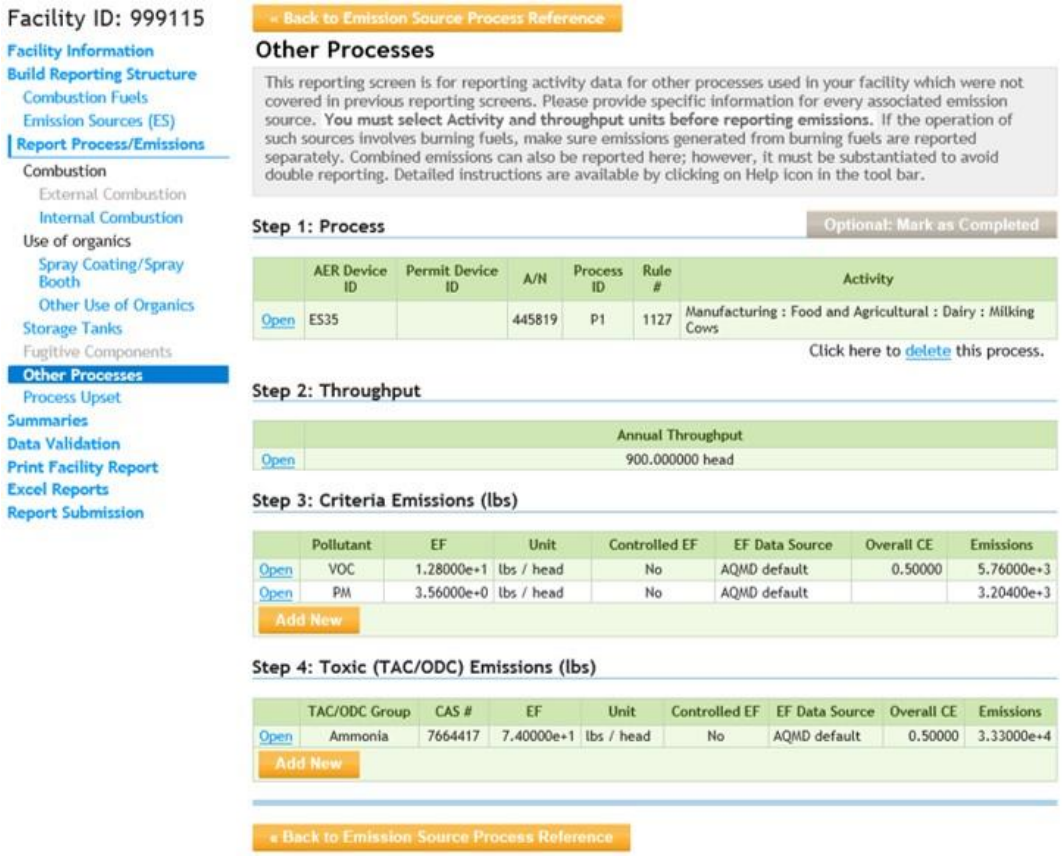


STEPS TO REPORT NH_3 (TAC/ODC)

Image 11: After saving, the program returns to Image 5. To add TAC/ODC emissions from the same Process P1, click the **Add Toxic (TAC/ODC)** Emissions under **Toxic Emissions** section (NH_3 emissions in this example). Select NH_3 (Ammonia) from the drop-down menu and select the applicable Emission Factor (from Table 1) and Control Efficiency (from Table 2) and enter them in the appropriate boxes. Click **Save** button.



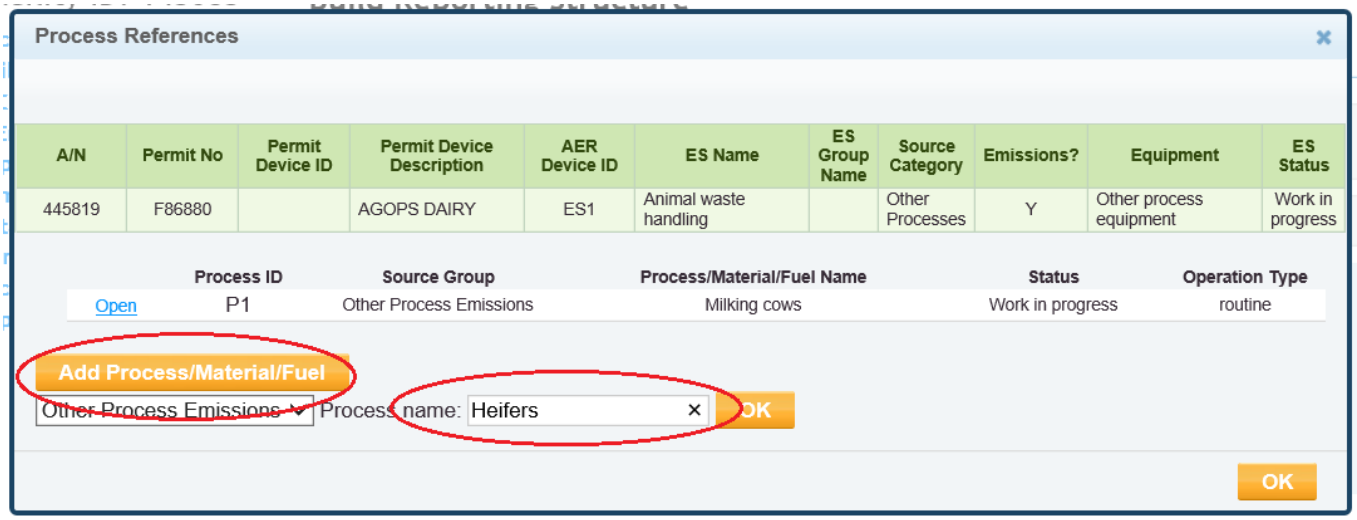
After saving, the program returns to Image 5. The emissions from the 900 Milking Cows have been reported as shown below.



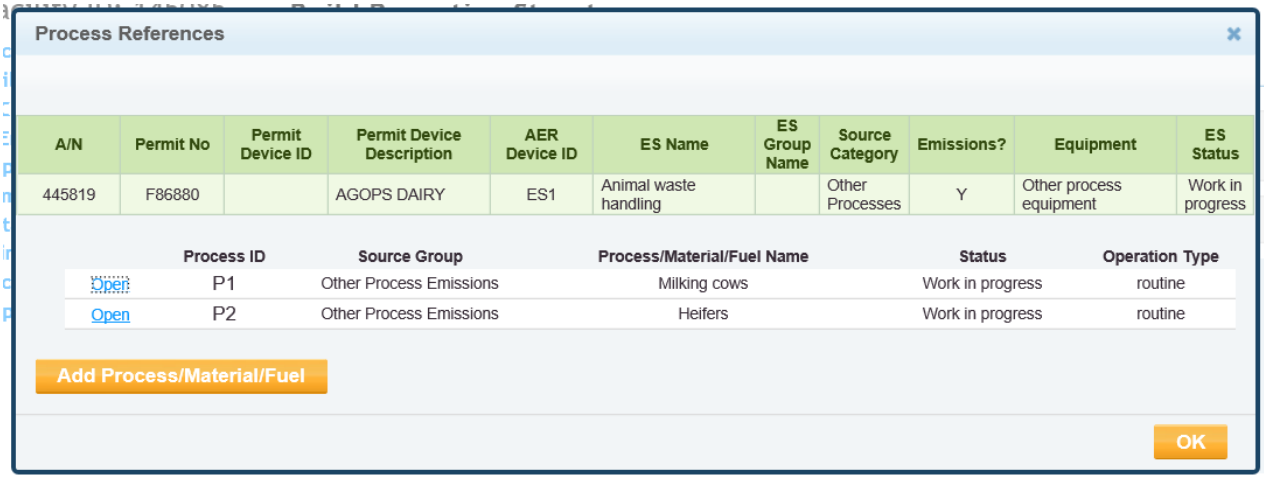
STEPS TO REPORT THE NEXT PROCESS

Image 12:

1. To add the next Process (Heifers), click "**Add Process/Material/Fuel"** button as shown below.
2. Name the Process (i.e. Heifers) in the box and click the OK button next to it.



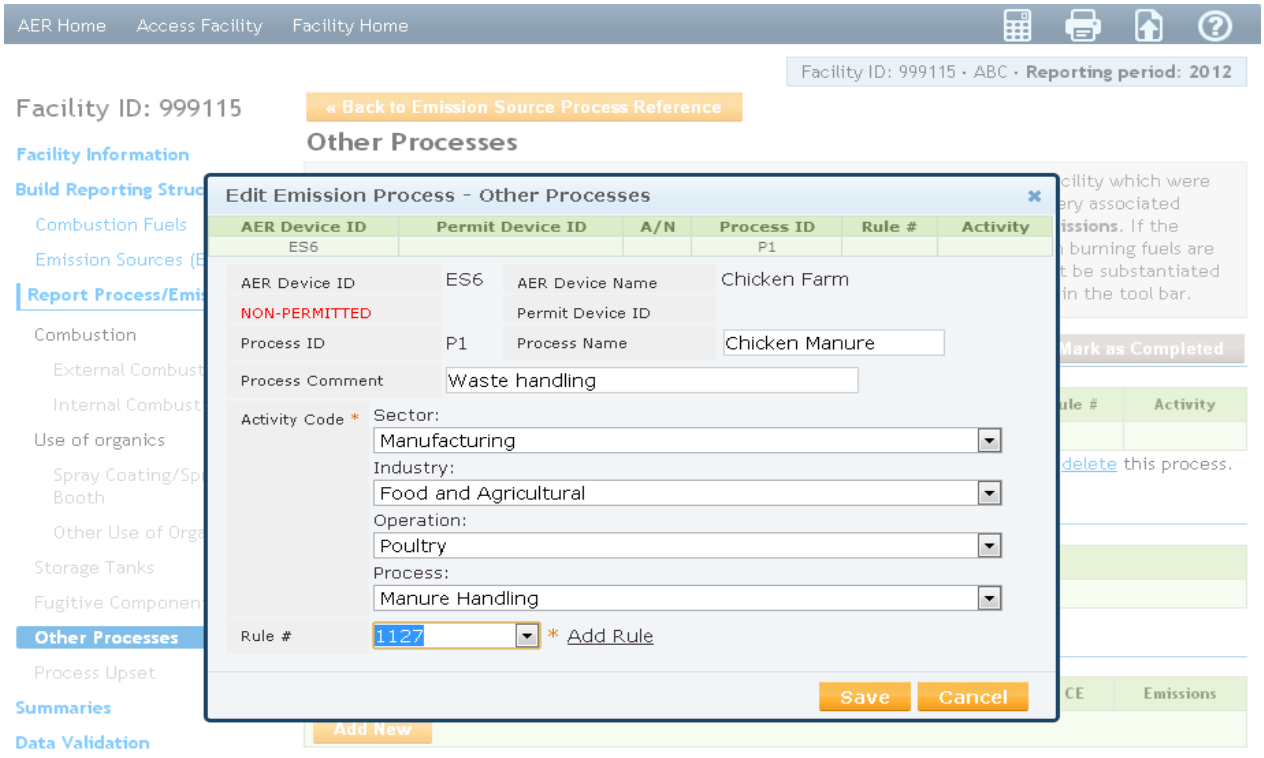
REMINDER:
To report the VOC, PM, and NH_3 emissions from the 300 Heifers, repeat the procedures as illustrated in Image 5 and follow the steps leading to Image 11.



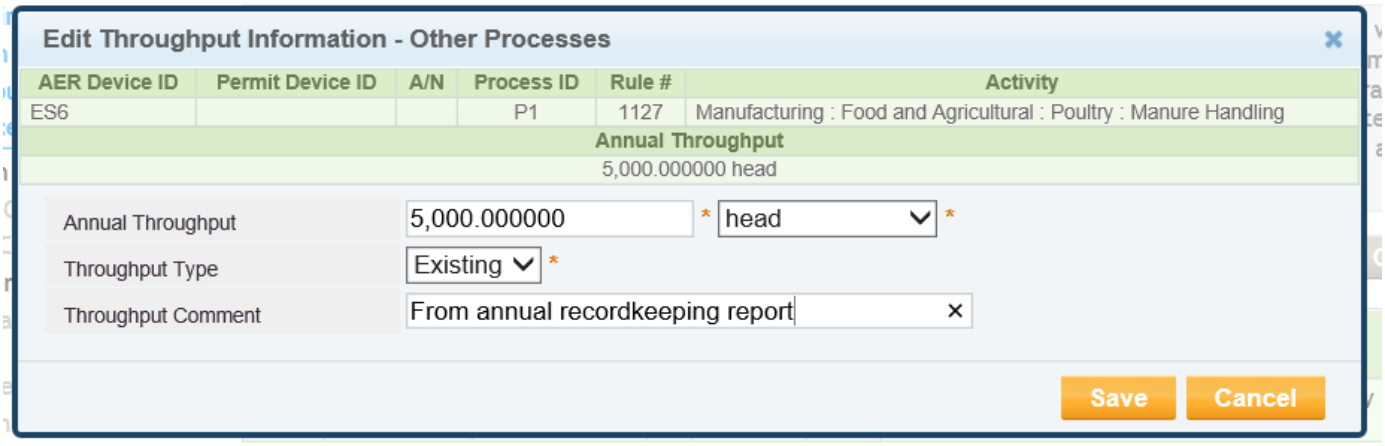
EXAMPLE 2:

Last year, a poultry farm facility raised 5,000 chicken on 100 tons of feed. The manure is sent out of the basin. This poultry does not have any lanes that are flushed with water to a pond.

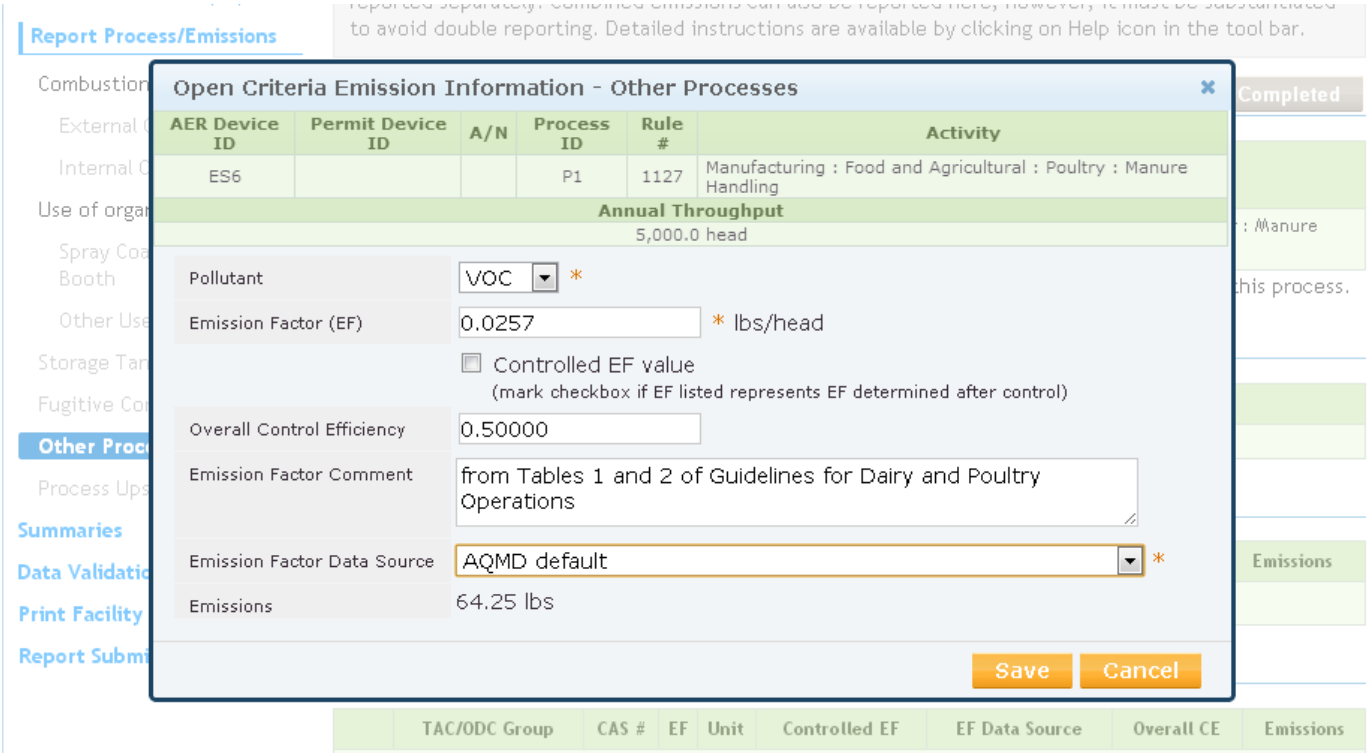
Since this poultry farm does not possess an operating permit, the user must add this emission source by clicking on the hyperlink "Add New Emission Source". Follow the procedure illustrated in Images 1-5 of Example 1 and fill in the information for Chicken Farm as shown in the following image. Click the **Save** button.



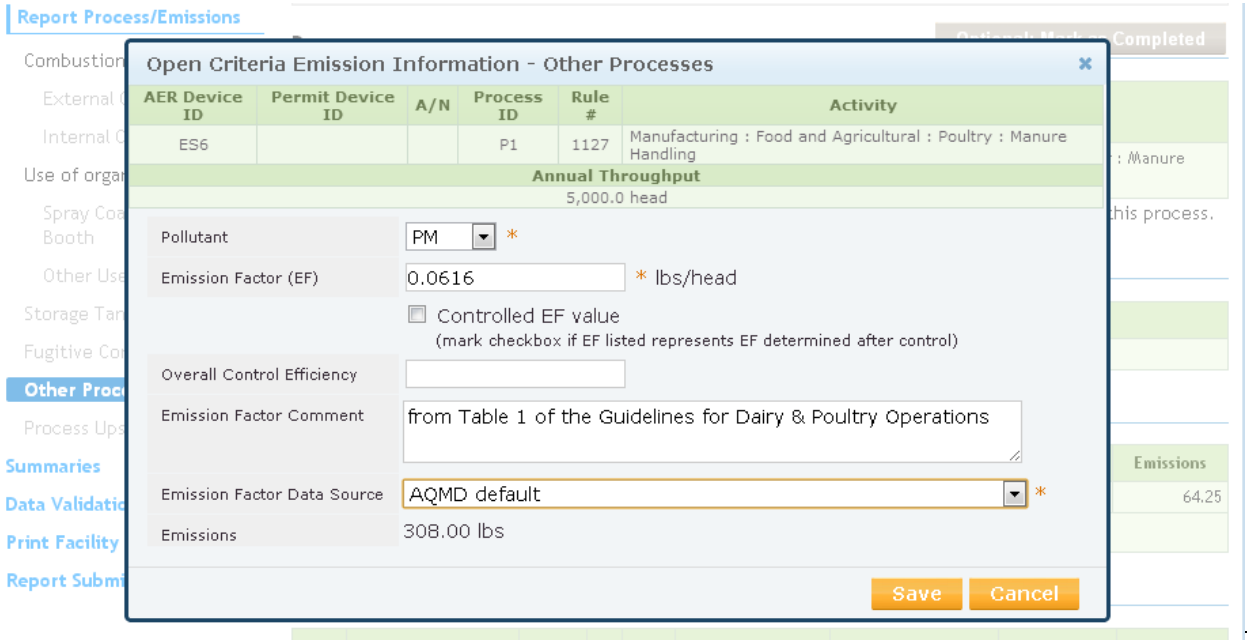
After saving, the program returns to Image 5. Open the **Throughput** section to enter the amount, as shown below. Click **Save** button.



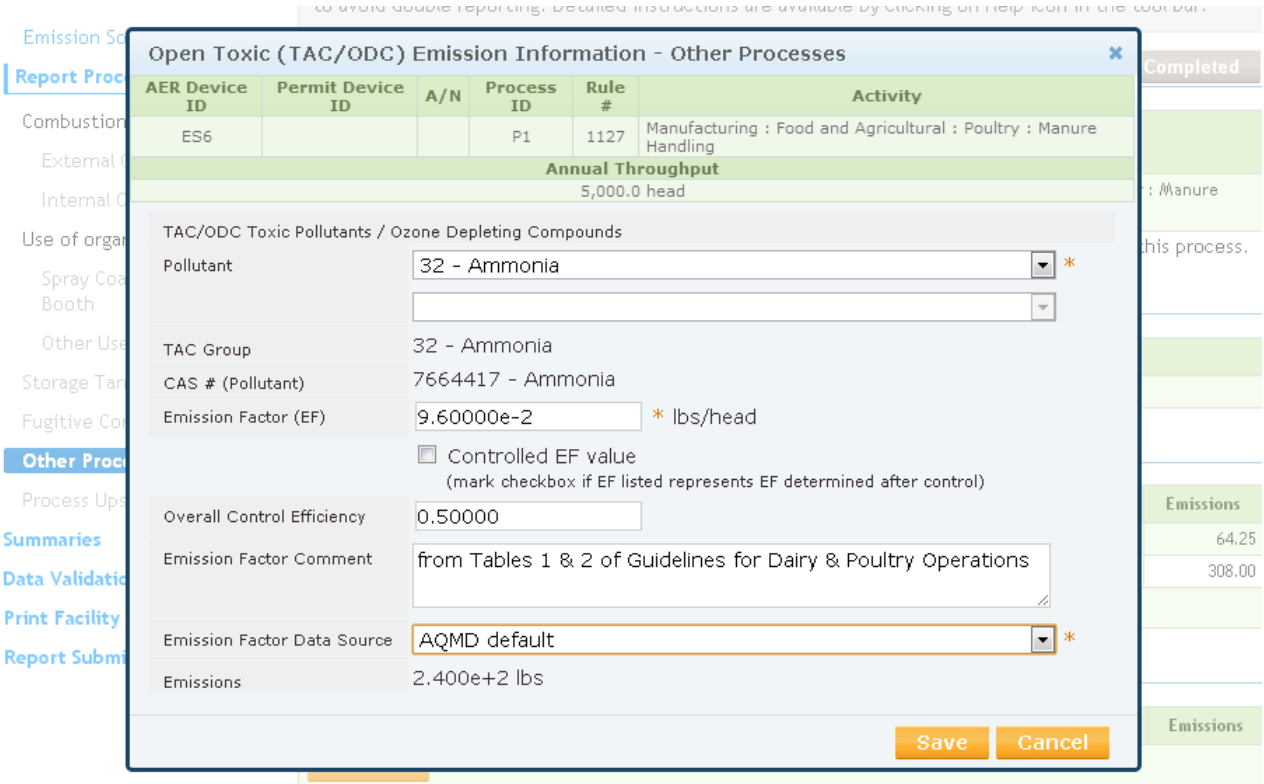
After saving, the program returns to Image 5. Open the **Criteria Emissions** section (by clicking **Add New**) to enter the criteria pollutant (i.e., VOC) and its emission factor information, as shown below. Click **Save** button.



After saving, the program returns to Image 5. Open the **Criteria Emissions** section again by clicking **Add New** to enter the next criteria pollutant (PM) and its emission factor information, as shown below. Click the **Save** button.

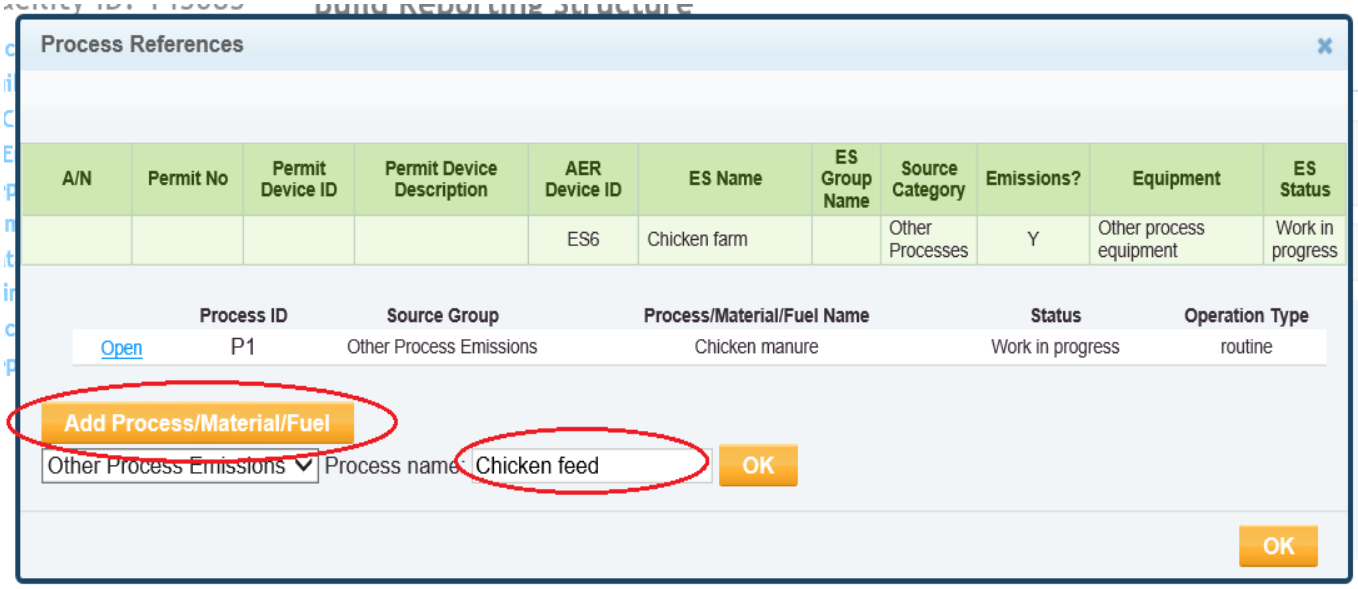


After saving, the program returns to Image 5. Open the **Toxic Emissions** section by clicking **Add New** to enter the TAC/ODC (i.e. NH_3) and its emission factor information, as shown below. Click **Save** button.

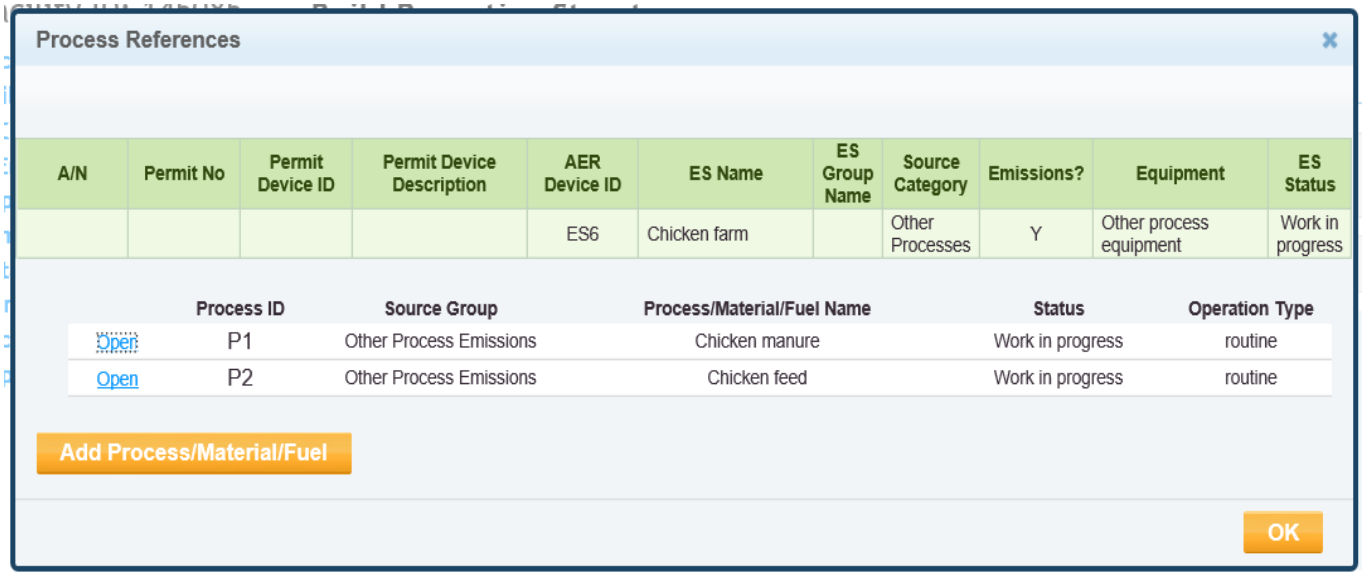


STEPS TO REPORT THE NEXT PROCESS FOR PM EMISSIONS FROM FEEDS.

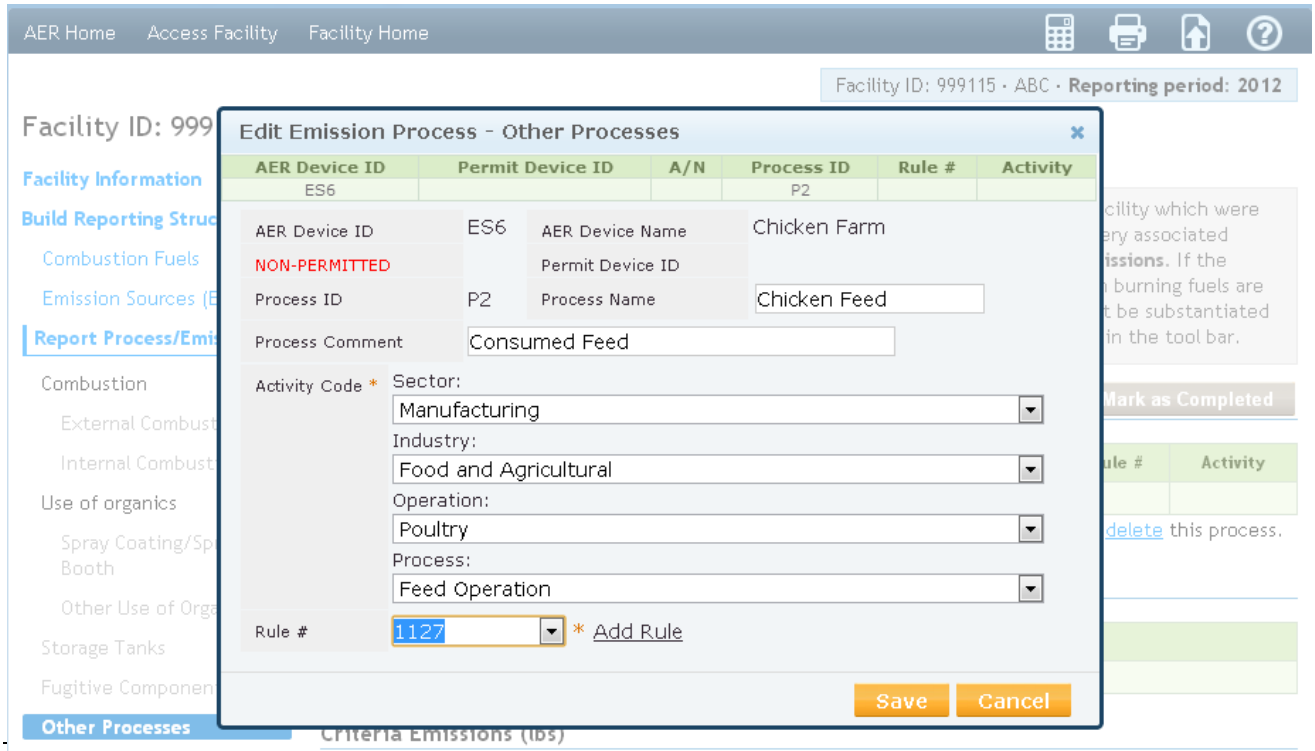
The following images will illustrate how to report emissions from handling of chicken feed. After saving, the program returns to Image 8. By clicking the **"Back to Emission Source Process Reference"** button at the bottom, the tool will pop up a screen (shown below) for user to add another process. Click "**Add Process/Material/Fuel"** button, name the process (i.e. Chicken Feed), and click OK button next to it.



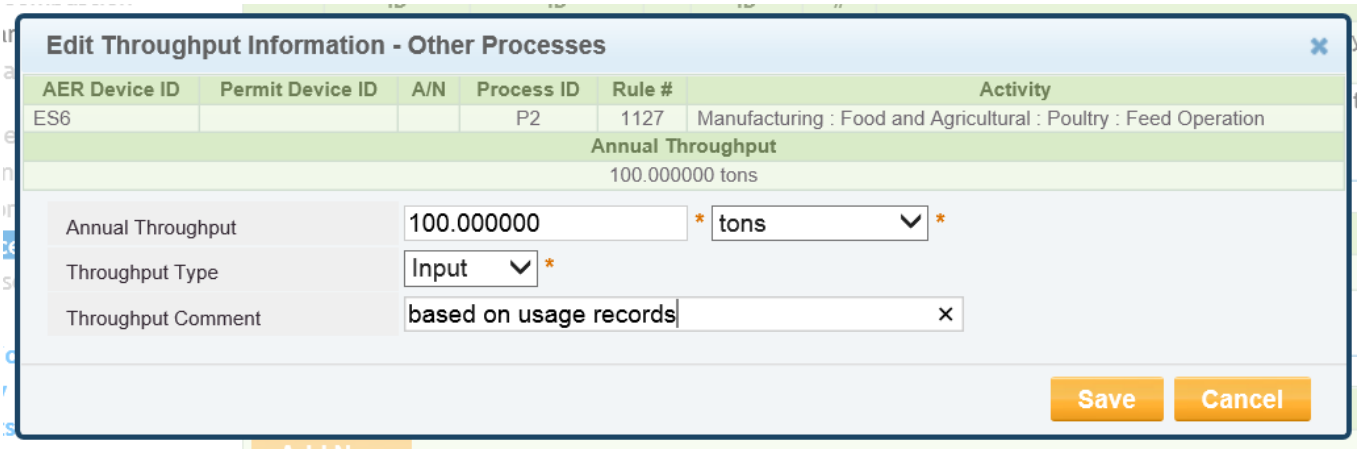
After clicking OK, process P2 is added for chicken feed operation as shown below. Click on "Open" for P2 and start entering the information for that process.



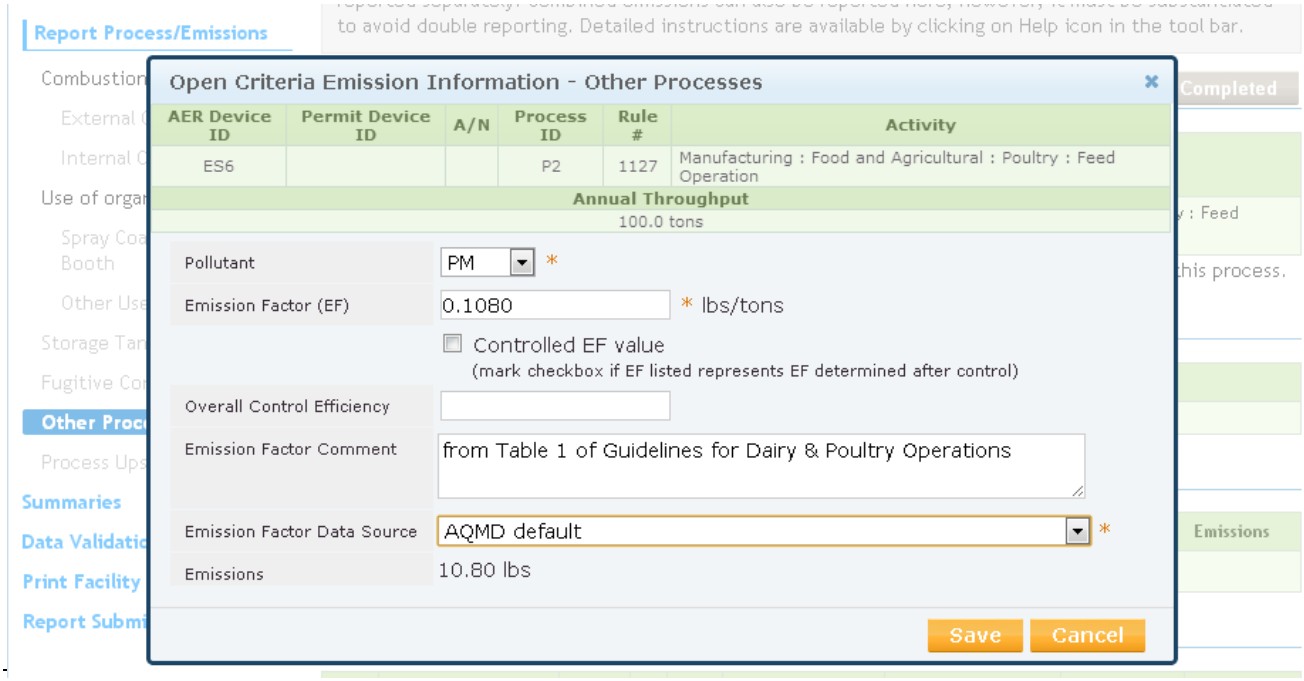
After clicking P2, the tool will present to user a process data entry screen similar to Image 5 where user can enter information for the steps as shown in the following screens. Use the drop-down arrow at the right of each box to report information for this process as shown below. Click the **Save** button.



After saving, the program returns to Image 5. Open the **Throughput** section to enter the amount, as shown below. Click **Save** button.



After saving, the program returns to Image 5. Open the **Criteria Emissions** section (by clicking **Add New**) to enter the criteria pollutant (i.e., PM) and its emission factor information, as shown below. Click the **Save** button.



After saving, the program returns to Image 5. Emissions from process P2 are reported. Complete the report by validating the entries.